RESULTS OF THE 1985 SPRING CLASSIFICATION COUNTS ON THE BATHURST BARREN-GROUND CARIBOU HERD

Northwest Territories Resources, Wildlife & Economic Development

103-05889/

RESULTS OF THE 1985 SPRING CLASSIFICATION COUNTS ON THE BATHURST BARREN-GROUND CARIBOU HERD

T. MARK WILLIAMS

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

YELLOWKNIFE, NWT

1990

File Report No. 89

ABSTRACT

Relatively few caribou (Rangifer tarandus groenlandicus) occupied taiga areas of Bathurst winter range in 1984/85. An aerial reconnaissance survey from 9 to 24 April 1985 located small scattered groups mainly of males in the taiga, a dense aggregation mainly of cows occupying a band running north along the tree line from Rocknest Lake, and a lower density band in the taiga running west from Rocknest Lake to the Calder River. An unknown number of caribou that wintered north of McLeod Bay, Great Slave Lake, had moved northeast onto the barrens by mid-January. By mid-April large bands mainly of breeding cows were migrating rapidly northeast from Rocknest Lake towards the calving grounds east of Bathurst Inlet. 1539 caribou were classified from three groups between 17 and 20 April 1985. Mean group size was 513 ± 218 (X+S.E.) and ranged from 240 to 1046. Of 1191 animals 1-year-old or older (1+), 19% were male, giving a sex ratio of 24 1+ males: 100 1+ females. Calf survival from June 1984 to April 1985 was 48%; greater than the mean survival rate (42%) calculated for the Beverly herd from 1978 to 1984. After incorporating the unrepresented male segment, Bathurst calves comprised 18% of that population, a recruitment rate into the 1+ population of 22%.

No wolves were observed in 49.5 hours of reconnaissance, suggesting low wolf abundance in association with taiga wintering bands of caribou. The segregation of calves, males and yearlings from bands of breeding cows prior to spring migration masks real changes in calf: 1+ female ratios and confounds overwinter mortality estimates. More intensive winter range reconnaissance and/or the placement of radio-collars on Bathurst cows would increase the efficiency of classification surveys by decreasing the amount of reconnaissance required to locate aggregations prior to and during spring migration, and by providing a means to estimate the proportion of tundra wintering animals.

TABLE OF CONTENTS

ABSTRACT iii

LIST OF FIGURES vii

LIST OF TABLES ix

INTRODUCTION 1

METHODS 3

RESULTS 6
Distribution and Movements 6
Classification Counts 9

DISCUSSION 11
Distribution and Movements 11
Classification Counts 14
Other Wildlife Sightings 16

RECOMMENDATIONS 17

ACKNOWLEDGEMENTS 18

PERSONAL COMMUNICATIONS 19

LITERATURE CITED 20

Appendix A. Calculations 22

Appendix B. Bathurst 1985 Class Counts - Itinerary 24

Appendix C. Cost of April 1985 Bathurst Spring Reconnaissance and Classification Survey. 26

LIST OF FIGURES

Figure 1. The Bathurst barren-ground caribou herd range. 4

Figure 2. Reconnaissance flights, 9-24 April 1985. 5

Figure 3. Distribution and movements of Bathurst caribou, April 1985. . 8

LIST OF TABLES

Table 1. Bathurst spring classification counts, April 1985 9

Table 2. A Comparison of 1984-1985 snowfall (cm) with mean (X) total monthly snowfall measurements from 1951-1980 for taiga and tundra areas of Bathurst winter range. 13

Table 3. Comparison of spring calf:100 1+ female rations and overwinter calf survival and recruitment estimates for the Beverly herd, 1978 to 1984, with 1985 Bathurst results. 15

Table 4. Sightings of muskoxen (Ovibos moschatus), moose (Alces alces) and wolverine (Gulo gulo) during Bathurst 1985 spring reconnaissance flights. 16

INTRODUCTION

Effective management of wildlife populations requires knowledge of population size, structure, productivity/recruitment and mortality. As part of its caribou management program, the Department of Renewable Resources, Government of the Northwest Territories, conducts annual spring classification counts to obtain recruitment indices for the four mainland barren-ground caribou (Rangifer tarandus groenlandicus) herds (Bluenose, Bathurst, Beverly and Kaminuriak).

Recruitment can be defined as the rate of breeding stock replacement (Davis and Valkenburg 1984); however, the year at which cows first bred varies among individuals, herds and years (Bergerud 1971, Dauphine 1976, Thomas et al. 1986, Whitten et al. 1986), and we cannot visually distinguish adult age classes. Therefore, we are unable to obtain an absolute measure of recruitment through visual sampling methods and must obtain an index. Yearlings (21-22 month old animals) may be underrepresented in spring classification counts as large yearlings may be indistinguishable from two year olds (33-34 month old animals). Calves (9-10 month old animals) are the only age class that can be consistently identified by visual means in the spring.

We agree that, in theory, age ratios cannot be interpreted without additional information, such as the relative size of the various cohorts composing a population, differential mortality of those cohorts and the population's rate of increase (Caughley 1974). In practice, the calf:1+ female (females 1 year old or older) ratio is a good index of recruitment as the variability of reproductive and adult mortality rates is low relative to the variability in calf mortality. Despite variation in the age at first

estrus, reproductive rates of mainland caribou 2 years old or older (2+) are consistently high, showing little variation among years or herds (Bergerud 1980). Yearlings die at a rate similar to that of older animals (Whitten et al. 1985) Variability in adult mortality rates is low because hunting and predation pressures are relatively constant over the age classes which constitute most of the population. In contrast, the vulnerability of calves to wolf predation throughout their first year (Bergerud 1980, Whitten et al. 1986) results in relatively high and variable mortality rates in the calf cohort (Bergerud 1980, Miller 1975, Parker 1972).

Knowing there is variability in adult mortality rates forces us to interpret small changes in calf:1+ female ratios with caution. However, large changes in calf proportions probably reflect real variability in calf mortality rates, and correlate with population growth rates (Alexander 1958).

By measuring mortality in the age class which shows the greatest variability, recruitment indices, as calculated from calf:1+ female ratios during annual spring classification counts, help explain observed trends in herd size and provide a qualitative index of herd health and potential for growth.

The calf:1+ female ratio is particularly useful as it does not require that assumptions be made concerning herd composition or calf mortality between late spring (March-April) and June. Those assumptions must be incorporated into calculations of percent recruitment into the 1+ population.

METHODS

From 9 to 24 April 1985, Renewable Resources personnel flew fixed wing (Cessna 337, DeHavilland Turbo Beaver and Cessna 310; see Appendix B) aircraft reconnaissance flights over the taiga and a large portion of the tundra winter range of the Bathurst herd (Figures 1 and 2).

From 17 to 20 April I flew reconnaissance and classification flights from the Lupin Mine site at Contwoyto Lake. A DeHavilland Turbo Beaver was used to position the author close to groups of caribou. The caribou were then approached on foot and were viewed with a 25 power spotting scope.

Unless a penis was visible, sex identification was based on the presence or absence of a vulva. Age categories were calves (11 month old animals), yearlings (23 month old animals), cows, young bulls and mature bulls. Calves were distinguished by their small body size and rounded face profile. Yearlings were intermediate-sized animals with a straight face profile. Young bulls were small-bodied males with at least one hard antler, while adult bulls were larger and antlerless.

Classifications were recorded on magnetic tape to be transferred later to a notebook.

To obtain age and sex ratios (e.g., calves to females over one year old), I used cluster sampling techniques (Cochran 1977:233, 249), treating each group of animals classified as a cluster. The ratios and their variances were determined with a ratio estimator formula (Cochran 1977:155, formula 6.13).

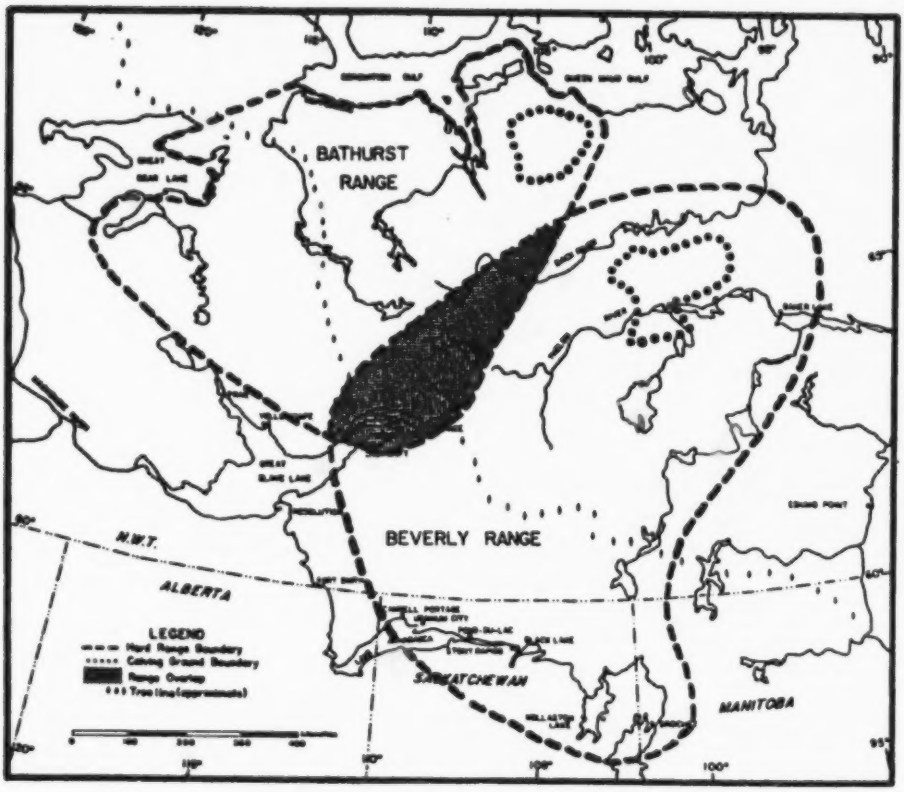

Figure 1. The Bathurst barren-ground caribou herd range.

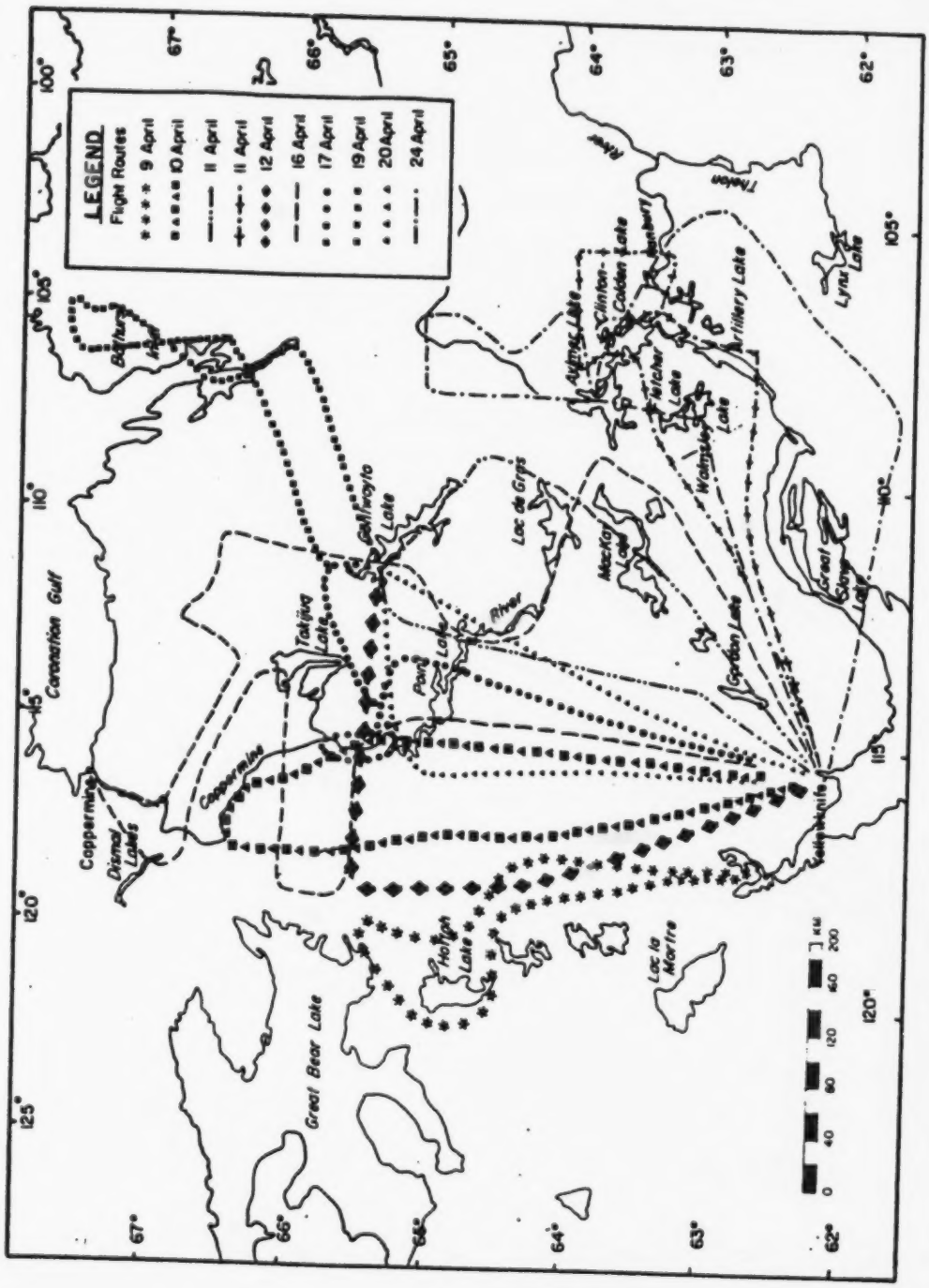

Figure 2. Reconnaissance flights, 9-24 April 1985.

RESULTS

Distribution and Movements

Reports from pilots, hunters and truck drivers suggest that small scattered groups, mainly of bulls, penetrated taiga portions of the winter range in the Indin Lake area between December 1984 and early February 1985 (D. Williams pers. comm.). Small groups, mainly bulls, were hunted along the Gordon Lake road corridor when the ice road opened in January. Most hunting activity had ceased by late January although hunters and truck drivers reported seeing some groups along the corridor as late as March (M. Williams unpubl. data). Residents of Bay Chimo reported that relatively large numbers of caribou wintered in the Bathurst Inlet area (A. Gunn pers. comm.). Also, residents of Coppermine hunted caribou in the vicinity of Takijuk Lake during late winter and early spring (A. Gunn pers. comm.).

Large numbers of Bathurst caribou may have wintered north of McLeod Bay, Great Slave Lake in early winter, but by mid-January only a few scattered groups of bulls remained north of Reliance and north of Taltheilei Narrows. Large areas that had been heavily tracked and northeast-southwest oriented trails were evidence that greater numbers had occupied and moved out of the area (D. Thomas pers. comm.). By February, very few caribou remained north of McLeod Bay (H. Kiliaan pers. comm.). In March, large northeast-southwest oriented trails between Clinton-Colden and Ayler lakes and north oriented trails north of Clinton-Colden Lake were observed by D. Thomas (pers. comm.).

Reconnaissance flights from 9 to 12 April 1985 located a few small, scattered groups of caribou east of McTavish Arm, Great Bear Lake, several groups north of the big bend on the Coppermine River and caribou north and

east of the big bend on the Coppermine River and caribou north and east of Clinton-Colden and Ptarmigan lakes (Figure 3). By far the largest aggregation of caribou was along the tree line north of Rocknest Lake with a lower density spur running west from Rocknest Lake to within 80 km of Great Bear Lake.

On 17 April, I followed a migration trail and large groups, mainly of breeding cows, northeast from Rocknest Lake, between Takijuq and Rockinghorse lakes to the north end of Contwoyto Lake. The vanguard of breeding cows was further advanced as a group of 800 caribou (mainly cows) was observed between the Mara River and Bathurst Inlet. These animals were migrating to the northeast and were approximately 150 km from the Bathurst calving ground. The migration of caribou northeast from Rocknest Lake appeared to be occurring rapidly as only one small area of cratering (evidence of feeding activity) was observed along approximately 150 km of trails.

By 24 April, there were no caribou in the Clinton-Colden Lake area. I observed migration trails in an area approximately 80 km southwest of Beechey Lake. Most trails were oriented northeast-southwest; however, some trails ran north-south and others east-west.

A reconnaissance flight along the eastern shore of Bathurst Inlet, 19 April, failed to confirm reports of large numbers of caribou in the Bay Chimo area. However, by the end of April and early May, heavy east-west migration trails were observed north of Bay Chimo. Residents of Bay Chimo felt that those trails were from Queen Maud Gulf caribou returning to the east to calve after wintering in the Bathurst Inlet area (A. Gunn pers. comm.).

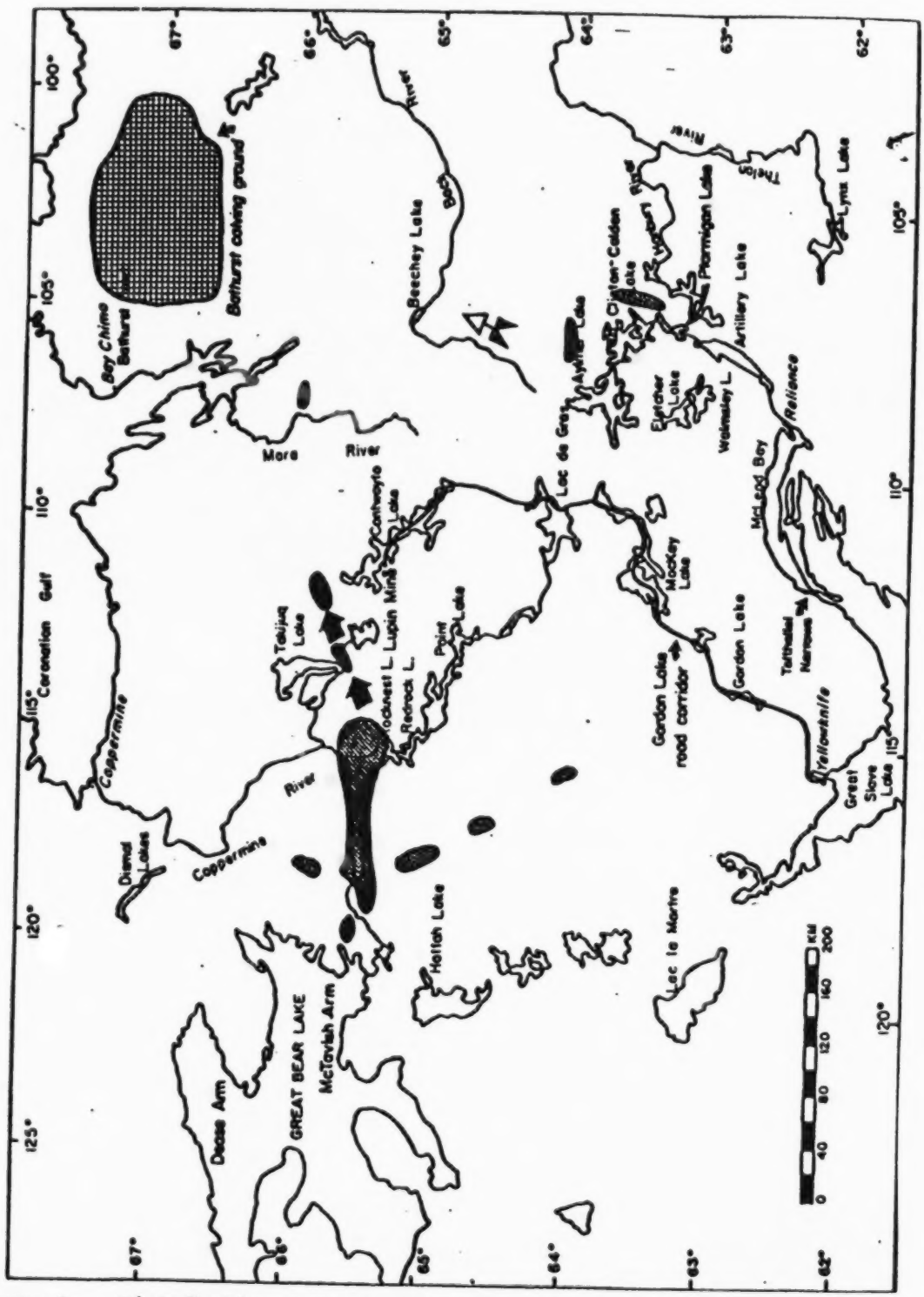

Figure 3. Distribution and movements of Bathurst caribou, April 1985.

Classification Counts

I classified 1539 caribou from three groups between 17 and 20 April 1985 (Table 1). The mean group size was 513 ± 218 (X±S.E.) caribou and ranged from 240 to 1046. Age and sex composition was 60% cows, 22.6% calves, 9.2% young (antlered) bulls, 4% mature (unantlered) bulls, 1.9% male yearlings and 2.3% female yearlings. Of animals 1 year old or older (1+), 19% were male and 81% female, giving a sex ratio of 24 1+ males:100 1+ females (Appendix A). Of 202 bulls 2 year old or older (2+), 141 (70%) were immature and 61 (30%) were mature.

Table 1. Bathurst spring classification counts, April 1985.

Group	Cows	Calves	Young bulls	Mature bulls	Yrlng males	Yrlng females	Total	% Cows	Calves: 100 fem
1	150	46	26	18	9	4	253	59	30
2	195	27	7	2	5	4	240	81	14
3	578	275	108	41	16	28	1046	55	45
Total	923	348	141	61	30	36	1539		36

The sample contained 23% calves or 36 ± 9 (R±S.E.) calves:100 1+ females. Survival of calves from June 1984 to April 1985 was 48%, assuming an initial calf production of 69 calves:100 females (Parker 1972) and annual natural mortality of 1+ females of 7.2% (Heard and Calef 1979, Appendix A).

I assumed that the observed sex ratio of 24 1+ males:100 1+ females was not representative of the herd's composition and that Gunn's (1984) fall 1982 estimate (for the Beverly caribou herd) of 61 1+ males:100 1+ females is representative. I then revised the calculations to incorporate the unrepresented male segment. The revised estimate is 18% calves. This represents a recruitment rate of 22% into the 1+ population (Appendix A).

DISCUSSION

Distribution and Movements

Few caribou occupied Bathurst taiga winter range during 1984/85. The observation of caribou signs north of McLeod Bay, Great Slave Lake, indicated that while some animals had occupied that area during the early winter, by January most had moved northeast out of the trees. Small scattered groups mainly of bulls were observed in frequently occupied areas around Gordon and northeast of Hottah lakes. The 1984/85 winter kill recorded at the Gordon Lake checking station contrasted with the 1983/84 results in that 3 times more animals were shot in 1983/84 than in 1984/85 (3900 vs. 1200) and a higher proportion of the 1983/84 kill was cows (M. Williams unpubl. data). Residents of the communities of Rae and Rae Lakes hunted mainly bull groups in the Indin Lake area from January to March (D. Williams pers. comm.). Increased hunting success in that area may be more related to improved access, with the improvement of the Indin Lake winter road in 1984/85, than to greater numbers of wintering caribou.

The only area where large numbers of Bathurst caribou were located was along the tree line where the Coppermine River runs north from Rocknest Lake to the Calder River. There are no previous accounts of concentrations of caribou forming in this area prior to moving northeast towards the calving grounds. This lack of information may be the result of the remoteness of the area; few residents hunt in the Rocknest Lake area and, therefore, caribou use could go unreported.

Results of the spring reconnaissance suggest that most of the Bathurst herd wintered on the barrens in 1984/85. Reports from residents of Bay Chimo

indicated that relatively large numbers of caribou wintered around Bathurst Inlet. A flight along the eastern shore of Bathurst Inlet on 19 April did not locate caribou. The only areas of Bathurst range not reconnoitred were the coastal areas of Coronation Gulf and west of Bathurst Inlet. Later reports suggest that many Bathurst and possibly some Queen Maud Gulf caribou may have been west of Bathurst Inlet in April and migrated eastward towards the Bathurst calving ground and Queen Maud Gulf in late April and early May. Residents of Coppermine hunted caribou at Dismal Lake and north of Takijuq Lake, both areas that we surveyed, and did not report large numbers of caribou along the coast. We feel that we located only a small proportion of the Bathurst herd in the spring of 1985. We may have missed wintering concentrations west of Bathurst Inlet.

Unusual use of wintering areas by Bathurst caribou in 1984/85 may be related to unusual snowfall patterns over the winter range. The taiga portion of the Bathurst range received an above normal snowfall in October followed by normal or below normal levels until the New Year. After the New Year, snowfall in the taiga was exceptionally heavy, with the Atmospheric Environment Service station in Yellowknife recording the greatest monthly accumulations in February and March since 1943 (Environment Canada monthly weather summaries). The western barrens (Coppermine) received above normal snowfall throughout the winter (Nov.-Feb., Table 2). In contrast, the central (Lupin mine at Contwoyto Lake) and eastern (Reliance) regions received below normal or normal snowfall in the fall and early winter (Oct.-Dec.) followed by exceptionally heavy accumulations in late winter and spring (Jan.-Apr., Table 2, A. Gunn, R. Toews, R. Catling pers. comm.).

The combination of heavy snowfall in the taiga and western tundra areas of the Bathurst range and unusually light snowfall on the central and eastern barrens may have caused most Bathurst caribou to winter on the barrens where forage would be more accessible and escape from predators easier.

Table 2. A Comparison of 1984-1985 snowfall (cm) with mean (X) total monthly snowfall measurements from 1951-1980 (*) for taiga and tundra areas of Bathurst winter range. (Data from monthly station summaries compiled by Atmospheric Environment Service, Environment Canada.)

Month	Yellowknife		Ft. Reliance		Coppermine		Contwoyto Lk.	
	84/85	X	84/85	X	84/85	X	84/85	X
Oct.	31.8	23.1	20.2	20.2	21.5	21.0	12.0	30.0
Nov.	31.0	30.0	18.2	25.7	29.0	15.1	13.2	15.1
Dec.	12.4	22.0	16.1	19.1	23.2	11.5	9.2	11.1
Jan.	14.8	15.5	22.2	14.4	26.4	9.2	9.2	7.0
Feb.	44.8**		13.1	28.8	13.2	16.1	6.4	11.6 8.6
Mar.	11.2	14.4	12.6	12.4	9.7	10.4	10.4	9.9
Apr.	28.4**		9.8	34.6	13.2	14.2	10.2	25.810.8
Total	174.4	127.9	152.7	120.2	140.1		83.8	91.492.5

* Canada, Department of the Environment 1982

** New record since 1943 (Environment Canada monthly weather summaries for Yellowknife).

Classification Counts

Few Bathurst class count data are available for comparison with April 1985 results; however, Beverly spring classification data is available for 1978 to 1984 (Table 3.) The 1985 calf:1+ female ration for Bathurst caribou (36±9) is greater than the mean value (32, n=6) determined for Beverly caribou. Also greater is the 1985 Bathurst overwinter calf survival 48%, compared to a mean of 43% for the Beverly herd.

The possibility of yearlings, males and calves being left behind by the breeding females at the start of spring migration makes it difficult to interpret calf:1+ female ratios. In the two groups (1 and 3) sampled north of Rocknest Lake (along the tree line) cows made up 55-59% of the sample (Table 1), whereas 81% of group 2 were cows and they were migrating rapidly across the barrens towards the calving ground. The animals at Rocknest Lake may also have segregated out from caribou further into the trees and, therefore, calves, yearlings, and males may be underrepresented. However, if one assumes representation of those age classes similar to that found during fall classification counts, calf survival over the winter of 1984/85 was above average.

We observed 2 wolf kills and no wolves in 49.5 hours of reconnaissance, indicating that relatively few wolves were associated with the taiga wintering bands of Bathurst caribou. Relatively large numbers of wolves were reported to be associated with wintering concentrations of Beverly caribou southeast of Great Slave Lake and with Bathurst caribou in the vicinity of MacKay Lake (R. Catling pers. comm.). As no wolves were observed during reconnaissance flights, it is possible that most wolves were associated with tundra wintering caribou and few remained in the trees by the start of our surveys.

Table 3. Comparison of spring calf:100 1+ female rations and overwinter calf survival and recruitment estimates for the Beverly herd, 1978 to 1984, with 1985 Bathurst results.

Year	Calves:100 1+ females (R±SE) (a)	% Overwinter calf survival (b)	% Recruitment	Source
1978	45 ±9.8	60	24 (c)	1
1979	18 ±1.6	24	10 (c)	1
1981	21 ±1.2	28	12 (c)	2
1982	43 ±2.7	57	27 (d)	3
1983	43 ±1.2	57	27 (d)	4
1984	22 ±2.0	29	14 (d)	5
Mean	32 ±18.5	43	19	
Bathurst 1985	36 ±9.0	48	22	6

a. Ratios and standard errors determined using ratio estimator formula from Cochran 1977 (155; formula 6.13). The sex ratio of unsexed yearlings was taken to be 1:1.
b. assuming initial calf production of 69 calves: 100 1+ females (Parker 1972) and annual natural mortality of 1+ females of 7.2% (Heard and Calef 1979).
c. assuming 70 1+ males: 100 1+ females (Heard and Decker 1980).
d. assuming 61 1+ males: 100 1+ females (Gunn in prep.).

1. Heard and Decker 1980
2. Elliott and Decker 1981
3. Williams and Heard 1986
4. Gunn in prep.
5. Williams and Heard in prep.
6. This report.

Other Wildlife Sightings

We observed 120 muskoxen (Ovibos moschatus) in 3 groups (mean group size = 40 ± 5, range, 30-50) in the Sifton Lake area and north of Contwoyto Lake (Table 4). We saw two single moose in the taiga, and a single wolverine on the barrens east of Fletcher Lake.

Table 4. Sightings of muskoxen (Ovibos moschatus), moose (Alces alces) and wolverine (Gulo gulo) during Bathurst 1985 spring reconnaissance flights.

Date	Number of animals	Species	Location	Comments
11/4	30	muskoxen	63°41'30"N, 106°14'W	E of Sifton Lake
11/4	50	muskoxen	63°51'N, 106°12'W	NE of Sifton Lake
19/4	40	muskoxen	66°01'N, 110°40'W	N of Contwoyto Lake
09/4	1	moose	64°16'N, 116°24'30"W	W of Ingray Lake
09/4	1	moose	65°19'N, 118°55'W	NW of Hottah Lake
11/4	1	wolverine	63°39'N, 108°38'W	E of Fletcher Lake

RECOMMENDATIONS

Past attempts to classify Bathurst caribou have been largely unsuccessful. One reason for this lack of success has been that insufficient data on winter distributions have been available to evaluate the proportion of animals remaining on the barrens, and to be aware of early migrations onto the barrens in the spring. That knowledge will be important if we wish to classify groups before the age and sex classes segregate out during spring migration. Therefore, I recommend that:

1) more reconnaissance work on the winter range be conducted, and/or
2) that radio-collars be used to: increase the efficiency of classification surveys by helping us to locate caribou aggregations, determine the proportion of tundra wintering animals, and to help monitor the location of rapidly migrating bands of caribou in the spring and fall;
3) spring classification counts continue to be conducted prior to the segregation of sex and age classes at the start of spring migration; and
4) that we continue to make use of the Lupin Mine site as an operations base when the distribution of caribou makes this a central location.

ACKNOWLEDGEMENTS

Mary Taitt assisted with a large proportion of the reconnaissance work and I thank her for her patience and enthusiasm.

I would also like to thank Bob McGilroy (Mine manager of Lupin Mine - Echo Bay Mines Ltd.) and staff at Lupin Mine for generously providing meals and accommodation at the mine site. Pilots Bill Bourque (Loon Air Ltd., Fort Smith) and Chuck Ross and Joe Halderson (Latham Island Airways, Yellowknife) provided safe and skillful flying. Bonnie Fournier and Isadore Charlo (Renewable Resources) participated in the reconnaissance work as observers. Doug Heard provided advice throughout the study and Doug Heard and Anne Gunn reviewed the manuscript.

PERSONAL COMMUNICATIONS

Gunn, Anne. Regional Biologist, Department of Renewable Resources, Government of the Northwest Territories, Coppermine, NWT.

Catling, Roger. Trapper, Reliance, NWT.

Kiliaan, Hank. Technician, Canadian Wildlife Service, Edmonton, Alberta.

Thomas, Don. Research Scientist, Canadian Wildlife Service, Edmonton, Alberta.

Toews, Roger. Renewable Resource Officer, Department of Renewable Resources, Government of the Northwest Territories, Baker Lake, NWT.

Williams, Dave. Renewable Resource Officer, Department of Renewable Resources, Government of the Northwest Territories, Rae, NWT.

LITERATURE CITED

Alexander, M.M. 1958. The place of aging in wildlife management. Am. Sci. 46: 123-137.

Bergerud, A.T. 1971. The population dynamics of Newfoundland caribou. Wildl. Monogr. 25. 55 pp.

Bergerud, A.T. 1980. A review of the population dynamics of caribou in North America. Proc. Int. Reindeer/Caribou Symp., Roros, Norway. 2: 556-581.

Canada, Department of the Environment. 1982. Canadian climate normals 1951-1980. Atmospheric Environment Service, Ottawa, Ontario.

Caughley, G. 1974. Interpretation of age ratios. J. Wildl. Manage. 38(3): 557-562.

Cochran, W.G. 1977. Sampling techniques. 3rd Edition. J. Wiley and Sons Ltd., New York. 413 pp.

Dauphine, T.C. 1976. Biology of the Kaminuriak population of barren-ground caribou. Part 4: Growth, reproduction and energy reserves. Can. Wildl. Serv. Rep. Ser. No. 38. 69 pp.

Davis, J.L. and P. Valkenburg. 1984. Demography of the Delta caribou herd under varying rates of natural mortality and harvest by humans. Alaska Dept. of Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-22-2, Juneau. 55 pp.

Elliot, C. and R. Decker. 1981. Results of the 1981 Beverly caribou spring segregation. NWT Wildl. Serv. unpubl. rep. 9 pp.

Gunn, A. 1984. Sex and age composition of the Beverly herd of barren-ground caribou in the fall of 1981 and 1982. NWT Wildl. Serv. File Rep. No. 40. 34 pp.

Gunn, A. in prep. Calf survival in the Beverly herd of barren-ground caribou. 1982-83. Department of Renewable Resources.

Heard, D.C. and G.W. Calef. 1979. The decline of the Kaminuriak caribou herd. NWT Wildl. Serv. unpubl. rep. 29 pp.

Heard, D.C. and R. Decker. 1980. An estimate of the size and structure of the Beverly caribou herd, 1978-79. NWT Wildl. Serv. unpubl. rep. 35 pp.

Miller, D.R. 1975. Observations of wolf predation on barren-ground caribou in winter. Proc. Int. Reindeer/Caribou Symp., Fairbanks, Alaska. 1:209-220.

Parker, G.R. 1972. The biology of the Kaminuriak population of barren-ground caribou, Part I. Can. Wild. Serv. Rep. Ser. No. 20. 95 pp.

Thomas, D.C., H.P.L. Kiliaan and C. Dong. 1986. Physical status of the Beverly herd of barren-ground caribou in December 1985. Can. Wildl. Serv. Rep. 27 pp.

Whitten, K.R., F.J. Mauer, G.W. Garner and D.E. Russell. 1985. Fall and winter movements and distribution, and annual mortality patterns of the Porcupine caribou herd, 1983-1984. Pages 515-526 In G.W. Garner and P.E. Reynolds (eds.). 1984 update report. Baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Alaska. 777 pp.

Whitten, K.R., F.J. Mauer, G.W. Garner and D.E. Russell. 1986. Porcupine herd. Pages 213-241 In G.W. Garner and P.E. Reynolds (eds.). Final Report. Baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Alaska. 695 pp.

Williams, T.M. and D.C. Heard. 1986. Composition of the Beverly herd in March and April 1982. NWT Department of Renewable Resources, File Rep. No. 60. 23 pp.

Williams, T.M. and D.C. Heard. in prep. Bathurst and Beverly caribou herd spring classification counts, March 1984. NWT Department of Renewable Resources, File Rep. No. 83.

Appendix A. Calculations

---

1. Sex ratio and % composition of animals over 1 year old in sample.

141 young bulls + 61 mature bulls + 30 male yearlings = 232 1+ males.

923 cows + 36 female yearlings = 959 1+ females.

% 1+ males = 232/(232+959)= 19%
% 1+ females = 959/(232+959)= 81%

Sex ration = (1+ males/1+ females) X 100 = 232/959 = 24 1+ males: 100 1+ females.

2. Percentage calves and ratio (R) of calves to 1+ females in sample.

348 calves/1539 = 23% calves in sample

(calves/[cows + female yearlings]) X 100 = 36 $\pm$ 9 (R $\pm$9 (R $\pm$S.E.R) calves: 100 1+ females (Cochran 1977: 155, formula 6.13).

3. Survival of calves from birth to late April (11 months).

assume (a) initial calf production of 69 calves:100 1+ females (Parker 1972) and,

(b) natural mortality of 1+ females of 7% (7.2% per year, Heard and Calef 1979). Therefore female survival from June 1984 = 93%.

Y cows in June x 0.93 = 100 cows in April
Y = 100/0.93 = 108, therefore 108 June cows = 100 April cows
69 calves/100 cows x 108 = 78 calves
75 calves/100 April cows ——> 36 calves/100 April cows
36/75 x 100 = 48% calf survival

4. Correction for unrepresented male segment.

Gunn (1984) found 61 1+ males:100 1+ females in fall 1982 for a sample of Beverly caribou.

61/100 x 959 1+ females = 585 1+ males

We found 232 1+ males, therefore, add 585 - 232 = 353 males.
total caribou = 1539 + 353 (1+ males) = 1892

corrected % calves = 348/1892 = 18%

5. Percent recruitment.

18% calves in population assuming 61 1+ males: 100 1+ females

18 calves/(100-18) 1+ animals + 18 calves = 18/82 + 18
18/82 x 100 = 22% recruitment into the 1+ population

Appendix B. Bathurst 1985 Class Counts - Itinerary

Date	
9 April - Tuesday	337 flight to Rae - picked up Isadore Charlo - reconnaissance to Hottah, Great Bear, returned through Indin Lake - Mark Williams and Mary Taitt.
10 April - Wednesday	337 - Mary Taitt and Bonnie Fournier flew to Coppermine River, down Coppermine through Point Lake to Yellowknife.
11 April - Thursday a.m.	337 - Mary Taitt flew NE through eastern end of Point Lake to Contwoyto Lake, down Contwoyto, swung east of Lac de Gras, through MacKay Lake to Yellowknife.
11 April - Thursday p.m.	337 - Mary Taitt flew ENE to N of Fletcher Lake, N and E of Aylmer and Clinton-Colden lakes, S down the eastern shore of Artillery Lake returning to Yellowknife.
12 April - Friday	337 - Mary Taitt flew N to western end of Point Lake - flew IFR to Lupin mine beacon and returned to Yellowknife.
13, 14, 15 April	Unable to fly due to weather.
16 April - Tuesday	337 - Mark Williams flew N through Point Lake to Coppermine River, west towards Great Bear Lake, then N and E to Takijuq Lake, NW to Dismal Lake, to Coppermine to refuel, from Coppermine flew SE to a point N of Takijuq, N and E to the James River south across Contwoyto Lake through Point Lake, Lac de Gras, swinging east past MacKay Lake returning to Yellowknife.
17 April - Wednesday	Turbo Beaver - pilot Chuck Ross and Mark Williams - flight N to Rocknest Lake, classified Group (1) caribou at Rocknest Lake - flew NE to Contwoyto Lake, classified Group (2) NW of Contwoyto, returned to Lupin Mine.
18 April - Thursday	Unable to fly due to weather.

19 April - Friday	Turbo Beaver - flew N and NE to Bathurst Inlet, N up eastern side of Inlet - E towards Brichta Lake, southwest to Inlet - south to Western River SW to Lupin Mine.
20 April - Saturday	Turbo Beaver - flew W to Coppermine River, classified Group (3), continued W, to the Calder River then S, returning to Yellowknife.
21-23 April	Unable to fly due to weather.
24 April - Wednesday	Cessna 310 - Joe Halderson pilot and Mark Williams flew NW to Walmsley Lake, N and then E to Beechey Lake, S to Aylmer, SE past Clinton-Colden to Tyrrell Lake, SW through Whitefish and Tent lakes to Gray Lake, returning W to Yellowknife.

Appendix C. Cost of April 1985 Bathurst Spring Reconnaissance and Classification Survey.

Item	Cost (x$1,000)
Cessna 337 reconnaissance - 32.9 hours	9.7
DeHavilland Turbo Beaver - 11.5 hours	5.0
Cessna 310 reconnaissance - 5.1 hours	2.6
Total	17.3